

AI-ENHANCED DESIGN AND LEGAL FOOTPRINT FROM INTELLECTUAL PROPERTY PERSPECTIVE

Tomislav Hudika¹ , Nika Bošković² , Anita Rubinić-Puller³ , Tihomir Katulić⁴ 

¹ University of Zagreb, Faculty of Graphic arts, Zagreb, Croatia

² Producta IP, Zagreb, Croatia

³ Ergomed Istraživanja, Zagreb, Croatia

⁴ University of Zagreb, Faculty of Law, Zagreb, Croatia

Abstract: The introduction of artificial intelligence into graphic design is widely understood as a fundamental game-changer. The rise of artificial intelligence (AI) in the form of applied machine learning has revolutionized the field of graphic design, introducing advanced tools to foster creativity and productivity. Machine learning has brought forth tools that enhance creativity and speed up work processes.

However, this technological progress also presents significant legal, especially intellectual property (IP) challenges that need to be addressed to safeguard innovation and ownership rights. This paper explores the intersection of AI-enhanced graphic design and IP issues. The core of AI enhanced design is commonly based on generative adversarial networks (GANs) and machine learning algorithms (MLA) in the design process where input parameters often include existing protected works under copyright.

These processing activities often present a challenge from an IP rights perspective. By analysing current EU legal framework and relevant case law, we present examples of processing activities where AI systems contributing to creative outputs fall under regulatory obligations and potential risk of litigation. The paper presents potential solutions and best practices for interdisciplinary work that includes engineers, designers and lawyers to navigate these challenges, hopefully contributing to bridging the gap between diverse fields incorporating technology and law that designers face in the era of AI-enhanced creativity.

Key words: Intellectual property, machine learning, artificial intelligence, copyright limitations, digital rights management

1. INTRODUCTION

In the recent years, AI-enhanced design (AIED) rose from an interesting and entertaining tool for creating design and various images for personal use to a semi or even fully professional tool potentially applicable in a variety of professional uses. With this advent of new capabilities inevitably came an enhanced PR coverage on social media, followed by a multitude of so-called “design gurus” providing tutorials how to make a quick profit using AIED. What often fails to be mentioned is the (mis)use of intellectual property and (lack of) its management when it comes to professional and commercial licensing and use. One of the most adopted AIED tools is Canva, with market share of 46.29% in September 2024, followed by Dall-E3, Leonardo AI and Adobe Firefly, all in their own domains of use (6sense, 2024).

According to the survey conducted for the purposes of this paper (with a survey group consisting of 62 respondents), nearly 43% of individuals using AI-enhanced design (AIED) tools fall within the 30-40 age group, with most holding graduate degrees.

Approximately 46% of respondents are familiar with AIED platforms, while 7% have never used them. (Google, 2024) Usage patterns show that 43.5% use these tools occasionally. Interestingly, a significant majority—almost 80%—believe that AIED enhances overall creativity and efficiency in the design process. However, 26% feel that AIED has the opposite effect.

When it comes to the artistic value of AI-generated designs, 46% of respondents believe they should not be considered works of art. Despite this, 58% are aware of the associated copyright issues, with 30% expressing significant concern and 46% somewhat concerned about them. Regarding ownership, a striking 55% of respondents think that all intellectual property (IP) rights related to designs should be attributed to the user (designer), while only 4% believe that the platform should hold these rights.

An overwhelming 90% of participants are concerned that AIED could lead to unintentional plagiarism or IP infringement. In terms of IP rights protection, 30.4% of respondents believe new regulations should offer greater protection to designers, while an equal percentage think the approach should be more collaborative. Additionally, 18% feel that AI developers deserve more protection. A staggering 91% agree

that a new IP strategy should specifically address AIED, while only 3% believe that current regulations are sufficient.

2. AI-ENHANCED DESIGN ALGORITHMS

AI-enhanced design refers to the integration of artificial intelligence (AI) technologies into the design process to augment human creativity and optimize design outcomes. This approach leverages machine learning algorithms, neural networks, and data-driven insights to assist designers in tasks that range from generating design variations to automating routine processes, such as background removal, colour correction, and layout adjustments. This is made possible via machine learning algorithms (MLA) or more precisely, by Generative Adversarial Networks (GANs) (Cohen & Giryes, 2023).

The GANs are a class of machine learning models that consist of two competing neural networks, known as the generator and the discriminator, which are trained together in a process of adversarial learning (GeeksforGeeks, n.d.). Introduced by Ian Goodfellow and colleagues in 2014 (Cohen & Giryes, 2023), GANs operate by having the generator create synthetic data—such as images, audio, or text—intended to be as realistic as possible, while the discriminator attempts to distinguish this fake data from real data drawn from a training set (Viso.ai, 2024; Chen et al., 2022).

Through this trial-and-error process, the generator improves its ability to produce data that can deceive the discriminator, while the discriminator becomes more adept at identifying fake data Figure 1. The training continues until the generator's output is nearly indistinguishable from real data. GANs could be used in various fields, including image generation and data augmentation, where they generate additional training data.

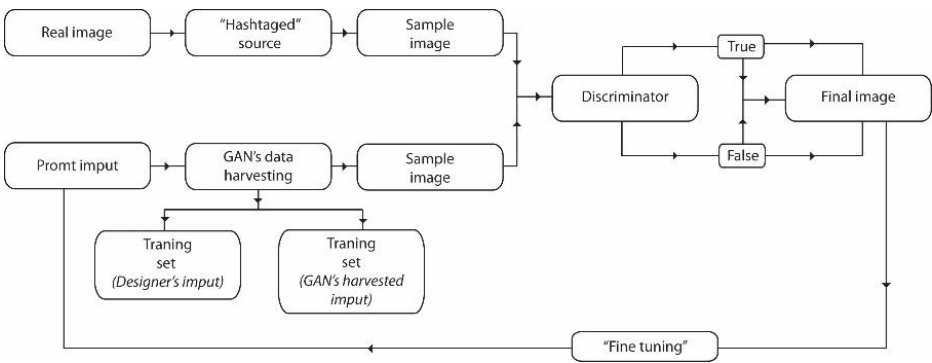


Figure 1: AIED/GAN diagram

With this in mind, GANs are the main sours of so-called deepfakes used to created illegal, harmful and misleading content such as various forms of pornography (Machine Learning Mastery, 2019; CVisionLab, 2024).

All these tools can operate autonomously or in collaboration with human designers, providing real-time feedback and recommendations. To create an image user is mostly required to insert a prompt code (PC). PCs are essential in building and directing GANs in applications like “text-to-image generation”.

In these contexts, a prompt serves as an initial input that instructs the generator on what type of content to create. For example, a textual prompt such as "river in the mountains" directs the generator to produce an image that aligns with this description. The GAN uses the prompt text to find its counterparts from the image library and test sets. This is not a new concept, but seen before with “#” options in various computer languages modules and later on in the so-called “hash-tagging” in the various social networks. One could conclude that the training set data was established years ago, when GANs were only doing data harvesting (AltexSoft, 2023; Gupta, 2023).

GANs can also effectively handle colour information in images by processing the pixel-based data that forms each image, rather than reading colour codes like RGB or hexadecimal values directly, which are also implemented in the image meta data. In practice, GANs treat images as matrices of pixel intensities, where each pixel's colour is represented by its red, green, and blue components (Boroujeni & Razi, 2024; Demir & Unal, 2018).

Through training, the generator in the GAN learns to reproduce the colours and patterns found in real images, while the discriminator evaluates both the colour and structural accuracy of the generated images

to determine in which amount each colour can be applied. This enables GANs to learn and replicate realistic colour patterns naturally, without explicit colour labelling. By doing the “fine tuning” in the midst of a training process, designer (human counterpart) can give specific directions which will then be used as a learning curve that will create images in the future (Demir & Unal, 2018; Lin et al., 2020).

GANs work with mostly RGB images, but they can be adapted to different colour spaces such as grayscale or HSV, depending on the specific task given by the designer. By learning colour distributions and intensity by data, GANs learn to produce precise images and patterns (Afifi et al., 2021).

3. THE INTERPLAY BETWEEN AI AND COPYRIGHT LAW

The legal implications of AI's growing role in the design industry remain uncertain, particularly concerning intellectual property rights. The challenges are arising around the identification, protection, and ownership of AI-generated designs. While the interplay between AI and copyright law, as well as AI and patent law, has garnered significant attention in the last couple of years, the relationship between AI and design law has been less explored (Lucchi, 2023; Quang, 2021). The use of AI technologies has been recognized as a major challenge for the European Union industrial design law framework. Both the European Union Intellectual Property Office (EUIPO) and the World Intellectual Property Organization (WIPO) have published studies assessing AI's impact on design infringement and enforcement (Kuypers & De Clercq, 2024).

Some AIEDs like Canva, do give the copyright to its creators under certain terms. The copyright will be granted to the creator of the original content (designer), but if the portions or even a training set was used from other websites as stock content, IP rights could be a subject of possible infringement of third parties right's. Canva in this case is not responsible for any third-party infringement issues that may arise, since the user has to comply with the terms of use. When it comes to AI generated content, such as images, most AIED such as DALL-E (Shoemaker, 2024), Imagen, Magic Media, the AI provider gives you exclusive rights. However, intellectual property rights are territorial rights and the scope of protection varies in different jurisdictions (Kuypers & De Clercq, 2024; Canva, 2024).

The question of design “ownership” arises when AI assists in the creation of designs with material human input. Under the Community Design Regulation of 2001, design rights belong to the designer or their successor, with joint ownership applying if multiple designers are involved. Most EU jurisdictions and EU regulation itself define the designer as a natural person or a legal entity who creates a design with a unique and individual character. Consequently, AI programs, even if true broad general-purpose intelligence was achieved, which is currently not the case, cannot be considered designers under EU law, as they lack legal personhood (Chen & Burgess, 2019; O’Leary, 2022). The European Commission suggests that the individual using AI technology should be regarded as the designer, provided the design meets the requirements of novelty and individual character (Kuypers & De Clercq, 2024). The bearer of registered design could be legal entities such as companies (i.e. Coca-Cola®), but only natural entity can be considered as a designer. Person who gave limited amount of assistance in the creation of design could not be considered as designer nor have any right arising from that design. If legal framework would be changed in the future regarding the term “person”, it could potentially give a legal leverage for AIED.

Moreover, during the “data harvesting” stage legality deepens on various factors, such as copyright, licensing and data protection (in US: data privacy) laws. It is well known that if the data used for training set is copyrighted, using it without permission can potentially lead to legal implications, especially if GAN will produce the end image that looks very similar to the original. In the Figure 2 one can see the proximity of the image tagged as “Snow-white” which refers to Disney’s cartoon character. In some cases, the fair use for specific situations can be applied, as for scientific research, academia or even to write an article of some sort, but those limitation are mostly very context-dependent. Some meta data with so-called open licences like CC or Creative Commons (Katulić & Jurić, 2014), depending on the class, comes with various restrictions and rules for commercial use, may require some sort of author attribution meaning that the best practices is to licence it prior using.

Another legal issue to consider are data protection laws, such as the EU GDPR or less ambitious sectorial or state laws in the US (HIPAA, CCPA) which regulate the protection and flow of personal data. Most of these laws, especially those based on the model of the earlier EU Data Protection Directive of 1995 or the 2016 General Data Protection Regulation operate under a strict set of principles (Art. 5 of the GDPR) which require a lawful, fair and transparent basis for the processing of personal data (Art. 6). Just because (personal) data is available online, does not necessarily imply that processing of such data is also allowed or legal. Data harvesting from various websites can also raise copyright issues. Finally, data sets used to

train GANs can lead to various other implication such as ethical issues or biased opinion, for instance, if someone would want to create harmful image of some religious, ethnical or other group, data set used to do so would lead the AIED powered by GAN in the direction that is set by that very training set. From the legislative perspective this is also addressed by new specific AI legislation, such as the EU AI Act (Figure 2).

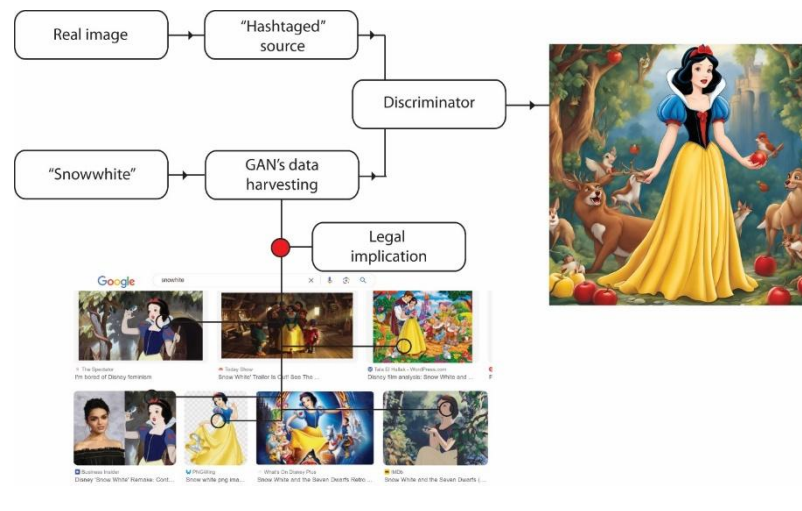


Figure 2: GAN harvesting (left and down) and end image (right)

4. EU LEGISLATION ON DESIGN PROTECTION IN DIGITAL AGE - *DE LEGE FERENDA*

Having in mind that the European legislation on industrial design protection has remained the same for the past 20 years or even longer, the EU lawmakers have made a decision to align the design protection in a way that it fits new digital age as well to align the procedures for application in a way that it is cheaper, faster, simpler and that it attracts more SMEs as well as design heavy industries to apply for design protection in the EU (EU Commission, 2024).

Industrial design rights protect the appearance of the product and therefore highly encourage innovation and creativity while giving the designer a legal monopoly on the design for a certain period of time in a certain territory. Under current design protection system in the EU, protection is granted for a period of 5 years, with the possibility of the proprietor to extend the protection up to 25 years.

More than 20 years ago, when design protection system was introduced, it was convenient and in line with the needs of the market. All EU Member States have partially harmonised systems of protection by implementation of the Directive 98/71/EU whereas at the EU level Council Regulation (EC) No 6/2002 established an independent system for the protection of design rights at the EU level as registered Community designs (RCDs) and unregistered Community designs (UCDs) that are protected without being registered if made available to the public. This EU level system is administered through European Union Intellectual Property Office, while complementary national systems are administered through national intellectual property offices (IPOs). The EUIPO is responsible for managing the registration of the European Union's trademarks and designs, ensuring protection across all EU Member States. It serves as a central hub for the enforcement of intellectual property rights, providing services and support for businesses, innovators, and legal professionals. The office also works on initiatives related to counterfeiting and intellectual property education across Europe. The Croatian State Intellectual Property Office (DZIV) is responsible for the protection of intellectual property rights in Croatia. It handles patents, trademarks, industrial designs, and copyright-related matters, offering services for registration, information, and support to creators, inventors, and businesses within Croatia. The office plays a key role in ensuring compliance with national and international IP regulations (Dziv, n.d.; EUIPO, n.d.).

Today, more and more designs are strictly used in a digital environment, and the end-products utilizing those designs are no longer just physical.

As design protection is often seen as a possible bridge between copyright and other industrial property rights, new EU design protection proposals suggest adapting the existing EU design protection legislation so that it would include digital designs, graphical user interfaces (GUIs), metaverse, non-fungible tokens and advanced technologies such as 3D printing. The design protection will also extend to movement, transition and any other sort of animation of the design's features.

At this point, it could be argued that design protection could in the future be a “tool” to be taken into consideration as a possible solution to the question of intellectual property rights on AI enhanced works containing design. In the resolution of 11 November 2021, European Parliament stressed that the EU design protection system is outdated and should be updated to allow new forms of design, apart from GUIs, also virtual and animated designs, fonts and icons. Also, it’s necessary to update the legislation as well as supporting systems such as special tools to conduct image searches to examine prior art that will give inputs to the examiners in IPOs as to what is considered to be “new”. This is most definitely an aspect in design protection that will most likely be conducted through artificial intelligence searching tools.

EU lawmakers are also suggesting to harmonise EU design protection system with EU trademark system in order to allow design holders to prevent design infringing products to enter the EU. This way, design proprietors will have certain powerful tools in order to fight infringements. Current proposals on updating of the legal framework both introduce broader definitions of the terms “product” and “design”. New broader definitions both include new designs that are not part of the physical product as well as objects that are available only in digital form. As far as visibility requirement goes, the proposals introduce that the protection should be granted only to features that are shown visibly in the application for registration. For instance, updates on definitions go in the direction that the word “digital” should be replaced by word “non-physical”.

Current EU legislation as well as the case law on the copyright protection of GUIs, which rules can easily be applied to other digital designs, grants copyright protection to such works. Specifically, the graphical user interface as a subject of copyright protection includes the visual elements and functions through which a user interacts with the computer program.

The graphical user interface as an object of copyright protection is also part of the definition in the Directive on the Legal Protection of Computer Programs, specifically in recital (10) of the preamble:

The function of a computer program is to communicate and work together with other components of a computer system and with users and, for this purpose, a logical and, where appropriate, physical interconnection and interaction is required to permit all elements of software and hardware to work with other software and hardware and with users in all the ways in which they are intended to function. The parts of the program which provide for such interconnection and interaction between elements of software and hardware are generally known as ‘interfaces. This functional interconnection and interaction is generally known as ‘interoperability’; such interoperability can be defined as the ability to exchange information and mutually to use the information which has been exchanged.

The Court of Justice of the European Union (CJEU) in its judgment in Case No. C-393/09 (*Bezpečnostní softwarová asociace v Ministerstvo kultury*) dated December 22, 2010, expressed the view that the design of a graphical user interface is subject to copyright protection, stating as follows:

*In this regard, it is important to determine whether the graphical user interface of a computer program can be protected under general copyright law pursuant to Directive 2001/29. The Court concluded that copyright protection under Directive 2001/29 applies only to a subject matter that is original in the sense that it is the intellectual creation of the author himself (see, in this regard, with respect to Article 2(a) of Directive 2001/29, *Infopaq International*, paragraphs 33 to 37). Thus, a graphical user interface can be protected by copyright as a work if it is the intellectual creation of the author himself.*

The idea of transparently involving copyright protected works into design protection systems on the EU level will require further legislative amendments in order for it to be possible to cumulate protection of designs and copyright (European Parliament, 2023).

5. CONCLUSION

The integration of AI into the graphic design field, particularly through AI-enhanced design (AIED) tools like Generative Adversarial Networks (GANs), has led the industry toward advancements in creativity and efficiency. However, these technological innovations bring with them significant legal challenges, especially concerning intellectual property rights and copyrights. As AIED for common use mostly rely on pre-existing meta data, which is often protected by copyright, determining ownership of AIED becomes a complex issue. The European Union is beginning to address the intersection of AI and design law, further clarity and fast paced updates of legal frameworks are necessary to ensure that both creators and AI developers are adequately protected. There is a constant growth in need for interdisciplinary collaboration between designers, developers, engineers and legal entities for establishing clear IP guidelines for AI-enhanced

creativity. This collaboration will be essential to push the innovation forward while safeguarding legal and ethical standards in the digital age.

6. REFERENCES

- 6sense. (2024) *Canva - Market Share, Competitor Insights in Presentation*. Available from: <https://6sense.com/tech/presentation/canva-market-share> [Accessed 3rd September 2024].
- Afifi, M., Brubaker, M.A. & Brown, M.S. (2021) HistoGAN: Controlling Colors of GAN-Generated and Real Images via Color Histograms. In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 19-25 June 2021, Nashville, Tennessee, USA. New York, IEEE. pp. 7937-7946.
- AltexSoft. (2023) *AI Image Generation Explained: Techniques, Applications, and Limitations*. Available from: <https://www.altexsoft.com/blog/ai-image-generation/> [Accessed 17th September 2024].
- Boroujeni, S. P. & Razi, A. (2024) IC-GAN: An Improved Conditional Generative Adversarial Network for RGB-to-IR image translation with applications to forest fire monitoring. *Expert Systems with Applications*. 238 (Part D), 121962.
- Canva. (2024) *Copyright ownership of designs made in Canva - Canva Help Center*. Available from: <https://www.canva.com/help/copyright-design-ownership/> [Accessed 3rd September 2024].
- Chen, J. & Burgess, P. (2019) The boundaries of legal personhood: how spontaneous intelligence can problematise differences between humans, artificial intelligence, companies and animals. *Artificial Intelligence and Law*. 27 (1), 73-92.
- Chen, Y., Yang, X-H., Wei, Z., Heidari, A. A., Zheng, N., Li, Z., Chen, H., Hu, H., Zhou, Q. & Guan, Q. (2022) Generative adversarial networks in medical image augmentation: a review. *Computers in Biology and Medicine*. 144, 105382.
- Cohen, G. & Giryas, R. (2023) Generative Adversarial Networks. In: *Machine Learning for Data Science Handbook. Data Mining and Knowledge Discovery Handbook, Third Edition*. pp. 375-400.
- CVisionLab. (2024) *Deepfake (Generative adversarial network)*. Available from: <https://www.cvisionlab.com/cases/deepfake-gan/> [Accessed 17th September 2024].
- Demir, U. & Unal, G. (2018) Patch-Based Image Inpainting with Generative Adversarial Networks. *Arxiv*. [Preprint] Available from: 10.48550/arXiv.1803.07422. [Accessed 9th March 2024].
- Dziv. (n.d.) *Državni zavod za intelektualno vlasništvo*. Available from: <https://www.dziv.hr/hr/> [Accessed 24th September 2024].
- EU Commission. (2024) *Revision of the EU legislation on design protection*.
- EUIPO. (n.d.) *Home - EUIPO*. Available from: <https://www.euipo.europa.eu/en> [Accessed 24th September 2024].
- European Parliament. (2023) In "A Europe Fit for the Digital Age." Available from: <https://www.europarl.europa.eu/legislative-train/theme-legal-affairs-juri/file-revision-of-the-design-directive-and-of-the-community-design-regulation> [Accessed 17th September 2024].
- GeeksforGeeks. (n.d.) *Generative Adversarial Network (GAN)*. Available from: <https://www.geeksforgeeks.org/generative-adversarial-network-gan/> [Accessed 3rd September 2024].
- Google. (2024) *AI-enhanced design tools and their implications on intellectual property (IP)*. Available from: https://docs.google.com/forms/d/e/1FAIpQLSfwYychGDyyaa_H6grYqXa78P4hWXBLUvmtCwSSPbKxYpujw/viewform?vc=0&c=0&w=1&flr=0 [Accessed 17th September 2024].
- Gupta, M. (2023) *How does DALL-E, the text-to-image generator work?* Available from: <https://medium.com/data-science-in-your-pocket/how-does-dall-e-the-text-to-image-generator-work-c2d9f4a0f26c> [Accessed 17th September 2024].
- Katulić, T. & Jurić, M. (2014) *Creative Commons License Agreements in Croatian Law*. Available from: <https://www.croris.hr/crosbi/publikacija/prilog-skup/614371> [Accessed 24th September 2024].

Kuypers, L. & De Clercq, K. (2024) *The interaction between AI and design: an analysis under EU design law*. Available from: <https://gevers.eu/blog/the-interaction-between-artificial-intelligence-and-design-an-analysis-under-eu-design-law/> [Accessed 3rd September 2024].

Lin, S., Qin, F., Li, Y., Bly, R.A., Moe, K.S., Hannaford, B. (2020) LC-GAN: Image-to-image Translation Based on Generative Adversarial Network for Endoscopic Images. In: *Proceedings of the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)*, 25-29 October 2020, Las Vegas, Nevada, USA. New York, Institute of Electrical and Electronics Engineers (IEEE). pp. 2914-2920.

Lucchi, N. (2023) ChatGPT: A case study on copyright challenges for generative AI systems. *European Journal of Risk Regulation*. 1–23.

Machine Learning Mastery. (2019) A Gentle Introduction to Generative Adversarial Networks (GANs). Available from: <https://machinelearningmastery.com/what-are-generative-adversarial-networks-gans/> [Accessed 9th March 2024].

O'Leary, D. E. (2022) *Using AI to Read Contracts*. Available from: <https://ssrn.com/abstract=4281936> or <http://dx.doi.org/10.2139/ssrn.4281936> [Accessed 6th October 2024].

Quang, J. (2021) Annual review. *Berkeley Technology Law Journal*. 36 (4), 1407–1435.

Shoemaker, E. (2024) Is AI art theft? The moral foundations of copyright law in the context of AI image generation. *Philosophy and Technology*. 37 (3), 1–21.

Viso.ai. (2024) *Guide to Generative Adversarial Networks (GANs) in 2024*. Available from: <https://viso.ai/deep-learning/generative-adversarial-networks-gan/> [Accessed 17th September 2024].



© 2024 Authors. Published by the University of Novi Sad, Faculty of Technical Sciences, Department of Graphic Engineering and Design. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license 3.0 Serbia (<http://creativecommons.org/licenses/by/3.0/rs/>).